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COVER

"Pikes Peak or Bust" became a positive reality for the members of the 64th Trans Co and the 45th Trans Bn (Hcptr) who took part in last summer's Operation Coldspot. These skilled Army Aviators and maintenance men put their H-34s through rigorous tests which evaluated the aircraft for mountain operations and provided valuable training for the men. Full details of this operation begin on page 5 of this issue.

Straight and Level

TO: Editor-in-Chief

I enjoy reading the Digest very much but have wondered why you don't include material about personal flying experiences. I think you're missing a good bet here.

Another area that would benefit from good material is in the field of maintenance.

T. E. BEATY
Captain CE
U. S. Military District,
Seattle, Washington

Thanks for your suggestions. In answering the first, we quote General Hutton's column in December 1955 Digest, "There are several fields in which a great deal of material is needed. Among these are: combat experiences, training programs, specific complaints about the Army Aviation program, descriptions of ideal equipment, solutions for maintenance problems, notes on inspections of air sections, safety programs, flying experiences ('I learned about flying from that' or 'Hangar Flying'), and communications problems and solutions." As you can see we welcome material about flying experiences. As for your second suggestion, we're working up a monthly page on maintenance. Look for it soon.—The Editor.

Dear Major Thompson:

I have just finished reading the January issue of "Army Aviation Digest" and noted your letter relating to dispensing smoke from aircraft. I further noted that the Army Aviation Safety Board looked askance at this mission. The "expert" on smoke dispensing may be the guy we have been looking for here in the Fourth Army Area. The angle iron attached to the bomb shackle of an L-19 was a similar installation to one which we found in the debris of an L-19 at Fort Hood.

A similar contraption for dispensing smoke was used at Fort Hood for various type missions requiring smoke, but as things will happen when regulations are violated, someone inadvertently placed a phosphorus grenade on this Rube Goldberg device. Fortunately or unfortunately the grenade went off on the parking ramp at Fort Hood and not while the aircraft was airborne. The net result was total loss of one L-19, one L-23, and another L-19 was severely damaged.

I hope the above information will be useful to you in your plans.

THOMAS H. EVANS, JR
Major Arty
Acting Aviation Officer
Headquarters, Fourth Army
Fort Sam Houston, Tex.

Although not addressed directly to the Digest, we reprint this letter to further inform our readers on dispensing smoke. Major Hubert A. Thompson, Headquarters, 82d Airborne Div, Fort Bragg, North Carolina, requested information on smoke dispensing in the January, 1957, Straight and Level.—The Editor.

Letters of constructive criticism are welcomed by the U. S. ARMY AVIATION DIGEST. To appear in this column they must be signed.—The Editor.

THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*
Commanding General, United States Army Aviation Center

Views expressed in this article are the author's and are not necessarily those of the Department of the Army.—The Editor

ORGANIZATIONAL MAINTENANCE

ALL FIGHTING EQUIPMENT is becoming more complex and more difficult to maintain. Army aircraft share this short-coming, and it is a limitation which we must learn to deal with.

In general, the Army's system of maintenance of all types of equipment is based upon the user's individual responsibility for each item, and also his pride and sense of ownership. The tank commander and his crew keep the tank in top condition not only because the responsibility is clearly defined but also because all are proud to have a smooth working and efficient piece of equipment.

For the last several years, under the contract maintenance system, the Aviation School has been teaching, at least by example, a maintenance philosophy which is entirely different from that described above. This might be called the fleet system. Maintenance is performed by specialists, while the personnel who operate the equipment have, for practical purposes, no maintenance responsibility. The fleet system is used by the airlines, and by most bus and truck operations, and it

has worked satisfactorily at the Army Aviation School where conditions resemble those under which fleet operators work.

There is certainly room for a very real doubt whether this system is satisfactory for field use in a tactical unit. The commander must have simple and direct lines of authority and responsibility, down through his subordinate leaders directly to the aircraft crews. All of these must carry their share of the total responsibility which rests upon the commander for the successful accomplishment of his mission.

This implies fixed assignment of crews—including flight personnel—to each aircraft and the assumption of basic maintenance responsibility by the aircraft commander. The end to be sought is closely parallel to the way in which a private airplane owner cares for and operates his own airplane. He assumes full responsibility to himself for the condition of his airplane and for its availability when he needs it.

The adoption of a good organizational maintenance system is especially important right now because the way we plan to accomplish the user's maintenance determines how the technical service support should be organized. If we organize the higher echelons first, there is a real danger that flexibility will be taken away from the tactical commander.

Right now, when the new divisional aviation companies are being organized and trained, is the time to try returning to the basic army maintenance system for our aircraft.

Mountain Operations With the H-34

Lt. Col. Donald F. Cassidy, TC

THE RUGGED TERRAIN of Korea proved that special techniques are necessary for the operation of rotary-wing aircraft in mountainous terrain. Such techniques have been developed, and the value of the helicopter in mountain operations has been reaffirmed, during "Exercise Coldspot" in September, 1956.

This well-planned exercise was the second of two such problems to evaluate helicopters in tactical operations in mountainous terrain. It was designed to provide short haul air transport of personnel, supplies, and equipment, while evaluating the performance of the H-34 at altitudes from 6,000 to 14,000 feet.

The helicopter flying experience of the aviator personnel ranged from seasoned professionals with thousands of hours and up to 16 years flying experience to recent school graduates with as little as 300 hours of flying time. In addition, two warrant officers had each logged 650 hours in the H-34.

The first platoon of the 64th Trans Co, Fort Hood, Texas, augmented by personnel of the 45th Trans Bn (Hcptr), Fort Sill, Okla., (comprised of three officers, 13 warrant officers and 23 enlisted specialists) took part in the operation after first undergoing an intensive pre-operation training program.

During the two training periods at Fort Carson and Camp Hale, Colo., and the actual operation in the vicinity of Cripple Creek and Pikes Peak, the H-34 proved satisfactory in air-lifting troops, light artillery and other equipment, miscellaneous cargo, both internally and externally, and in medical evacuation missions. Supply, maintenance and logistic problems which cropped up during the operation were completely evaluated.

In combining the problems of helicopter support to ground troops with those peculiar to mountain and high altitude operations, the H-34 performed extremely well in the skilled hands of the test personnel. With a swiftness characteristic of the Army's new air mobility, five H-34s landed 40 combat-equipped troops atop Pikes Peak in the remarkably short time of 20 minutes from a distance of 20 miles.

LOADS

Logistical problems and requirements for this mountain operation were generally the same

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Lt. Colonel Donald F. Cassidy, TC, is Commanding Officer, 45th Transportation Bn, (Hcptr), Ft. Sill, Oklahoma. *Views expressed in this article are the author's and are not necessarily those of the Department of the Army or the U. S. Army Aviation School.—The Editor.*

as for operations conducted at lower altitudes. Both internal and sling loads were tested. The pilots unanimously agreed that carrying external loads was a precarious operation, because of the precision flying necessary to place a sling load on an exact spot on a peak on the initial approach. Internal loads were favored whenever possible. Only an exceptionally well qualified pilot could be expected to carry a sling load at altitudes above 10,000 feet.

Although the helicopters operated at altitudes ranging from 9,250 to 14,110 feet on approach and takeoff, the payload weight rarely went below 1,000 lbs. On the 14,110 foot summit of Pikes Peak with a density altitude of 16,200 feet, the H-34 lifted 1,600 lbs with a short ground roll on takeoff. The highest payload totaled 1,700 lbs at a density altitude of 14,250 feet and a gross weight of 10,385 lbs.

Although some maneuver officials were skeptical, six 75mm pack howitzers were airlifted from a location 11,500 feet high to a 10,880-foot point 16 miles away. This operation required four helicopters and was completed in two hours. However, air crews suffered from a lack of oxygen during this high-level task.

Throughout the operation cargo nylon nets with a 2,000 pound test were used. This net was improved by using a special snap link which allowed the net to be drawn tightly around the load and made it possible to carry the cargo close to the belly of the aircraft.

High-altitude operations require skilled Army Aviators.

MEDICAL EVACUATION

The medical evacuation potential of the helicopter, documented in Korea, was proved anew when 75 simulated casualties were airlifted two and one-half miles from a point 12,750 feet high

to the battalion aid station, located at the 10,000 foot level. An equal number of replacements was airlifted back to the initial point. This phase of the operation demonstrated that some medical personnel were not thoroughly familiar with the capabilities and tactics of a helicopter unit. In some cases, the helicopter landing sites selected by medical personnel proved to be unsatisfactory and the required reselection resulted in delay.

COMMUNICATIONS

The installed communication equipment proved to be inadequate for this type of operation. Three types of equipment were included for testing. Radio Set ARC, type 12, operated unsatisfactorily since it is capable of line-of-sight operation only, and aircraft operating below this line of sight between the aircraft and station could not communicate. Radio Set AN-PRC-10A proved to have inadequate range and frequency coverage for maintaining operation. Radio Set AN/URC-4, w/vest radio carrier, E-1, was not evaluated since this set was restricted to emergency use only and was not needed during the operation.

MAINTENANCE

Despite the mountains, rough

Operation Coldspot Army Aviators pose before an H-34.

terrain, dust and sand on the airframe, rotor, and engine, the over-all mechanical reliability of the H-34 proved excellent. The few exceptions grew out of the inherent peculiarities of the location of the operation.

Since liquid expands at higher altitudes, the oil level had to be maintained a gallon low. Five gallons of hydraulic fluid were consumed, mostly by the brake cylinder leak resulting from excessive expansion of the hydraulic fluid. The fuel quantity gauges shorted internally as a result of the condensation due to the rapid changes in temperatures that occur at high altitudes.

The need for oxygen equipment and the necessity of attaching six-foot ground cables to the left landing gear of the helicopters, in order to eliminate the dangerous hazard of static electricity prevalent at high altitudes, are considered necessities for future sustained operations.

With repairmen available on a 24-hour basis, an availability rate of 85 per cent was maintained throughout this period. Each of the seven aircraft had a crew chief and a helper. A sheet metal mechanic was necessary to repair oil cooler brackets which were damaged by the excessive vibration and to handle miscellaneous sheet metal repairs.

Troops disperse after unloading in rugged terrain.

CONCLUSION

Throughout Operation Coldspot, aviators compiled invaluable information bearing on the techniques of high altitude mountain flying. In reviewing this information, the following techniques and procedures proved to be of particular importance.

1. Control movements must be made slowly and smoothly since abrupt movements resulted in loss of lift followed by settling.

2. The maximum allowable rpm was generally maintained during approaches and takeoffs and whenever power losses were anticipated.

3. Engine efficiency was lost at the rate of one inch of manifold pressure per thousand feet increase in altitude. The allowable gross load was reduced at the rate of 200 lbs per thousand feet increase in altitude. Density altitude charts were mandatory for computing power requirements.

4. Missions conducted in the early morning or late evening had the advantage of low density altitudes.

5. Steep approaches were avoided.

6. Pinnacle sites were preferred for landing and takeoff.

7. Safe cruising airspeeds were reduced to between 60-70 knots, due to retreating blade stall which resulted from the turbulence found in mountainous terrain.

8. Flight paths were most easily and safely conducted on the windward side of hills at a point one-third of the way down from the crest.

9. In severe turbulence, flights were conducted as close to the ground as safety permitted.

10. One hundred and eighty degree turns were made to recover from severe downdrafts.

11. Excessive pilot fatigue was experienced and a co-pilot was considered mandatory.

12. Air crews suffered from lack of oxygen when participating in operations of more than one hour duration at altitudes above 10,000 feet. Reaction time and judgment were reduced to a point where aircraft and crew were endangered.

Operationally, the H-34A helicopter proved itself safe and serviceable for use in mountainous terrain, capable of efficient and rapid support for ground units operating in such terrain. Its full potential is limited, however, by inadequate power.

Supervising officials recommended that consideration be given to increasing the power available in future models of this type helicopter.

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The Mountain Wave

Major John H. Hall, *USAF*

An unusual form of lenticular cloud associated with a mountain wave. Photographs by Robert Symons, Bishop, Calif.

OROGRAPHIC MOUNTAIN turbulence is as old as aviation itself, but only in recent years have the various phenomena associated with strong airflow over rough terrain been organized into a simplified model commonly known today as the mountain wave.

Characteristics of a typical mountain wave are shown on pages 12 and 13. The first is a photograph of a cloud formation normally encountered with wave development. The second figure illustrates schematically the airflow in a similar situation. As depicted, the air flows smoothly with a lifting component as it moves along the windward side of the mountain. The wind speed gradually increases to maximum near the summit.

Upon passing the crest, the flow breaks down into a much more complicated pattern with downdrafts predominating. Turbulence in varying degrees can be expected as diagram shows and is likely to be particularly severe in the lower levels. Proceeding downwind for perhaps five to ten miles from the summit, the airflow begins to ascend as part of a definite wave pattern. Additional waves, generally less intense than the primary wave, may also form downwind. In some areas, as many as six and even more have been reported, resembling the series of ripples which form downstream from a rock submerged in a fast flowing stream. Indications of three waves can be seen in picture on page 14.

The pilot is primarily concerned with the first wave because of its more intense action and closer proximity to the mountainous terrain. The horizontal distance between successive waves usually ranges from two to ten miles, depending upon the existing windspeed and atmospheric stability, but wave lengths up to 20 miles have been reported.

Pilots have been aware of erratic airflow over mountainous terrain for some time, particularly when winds are in excess of 25 knots. Not much was known about the magnitude and nature of this phenomenon until extensive research was launched into numerous, unexplained aircraft accidents. While there is still much to be learned, we now know that the mountain wave is capable of producing more violent turbulence than any thunderstorm except a tornado. It demands and deserves the humble respect of all aviators.

Sailplane pilots have contributed greatly toward a better understanding of the mountain wave over the past 20 years. These pilots have long taken advantage of the rising air currents on the windward side of a mountain. During the 1930's, these sailplane pilots observed that strong currents which rose to great heights were occasionally encountered on the lee side of a mountain. In the wake of this discovery, record flights of more than 30,000 feet were recorded by utilizing these strong

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Major John H. Hall, USAF, is Commanding Officer, 14th Det., 25th Weather Sqdn. Photographs and background information for this article are from a U. S. Department of Commerce Weather Bureau bulletin. Views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor.

Typical cloud formations encountered with mountain wave development. The cap cloud partially covers the mountain to the right, the roll cloud is parallel to the mountain and extending across most of the picture, and the lenticular clouds are in the upper left. Air flow is from right to left.

currents on the lee side of the Alps. The present sailplane record of 44,500 feet was established near Bishop, Calif., in 1952 by using the mountain wave on the lee side of the Sierra Nevada mountains during a period of strong wave activity.

Because of their great heights, the Sierra Nevada mountains and the Great Divide naturally come to mind when mountain waves are discussed. It has been established, however, that any mountain range with a crest 300 feet or higher is capable of producing wave phenomena. Consequently, mountain waves may be experienced in many parts of the nation and wave phenomena have occurred at heights up to 75,000 feet over a roll of hills only several hundred feet high.

Wave turbulence takes many forms ranging from smooth up and down drafts in the laminar flow to violent sharp edged gusts which have been measured as high as 40 feet per second at almost any level up to 40,000 feet. Up and down drafts reach their peak at about 5,000 feet per minute in the rotor cloud zone which is also the most favored spot for the sharp edged gusts. It is presently impossible to determine which waves will produce turbulence and which will produce only smooth drafts at 18,000 feet or higher. It seems reasonable to assume, however, that the conditions which produce a strong wave should also be favorable for the development of appreciable turbulence at some stage during its life span. It is highly probable that any mountain wave will produce moderate or severe turbulence immediately in the lee of the mountain near and below the summit.

It is possible for a wave formation to develop when the air is too dry to produce clouds, but

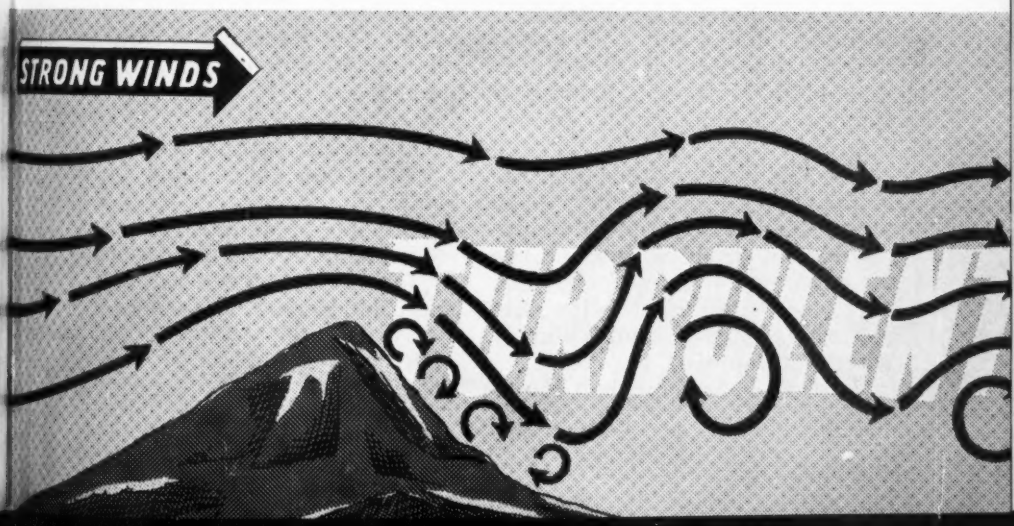
this condition is relatively rare and cloud formations still remain as the best means for identifying the presence of a wave before encountering it. Some typical cloud formations are as follows:

1. *Cap Clouds:* As its name implies, this is a low hanging cloud with its base near or below the mountain's summit and a relatively smooth top only a few thousand feet above the ridge. The major portion of this cloud is found on the windward slope where it usually discharges light snow or rain. The leeward edge remains stationary, as an apparent wall when viewed from downwind, with fibrous fingers reaching part way down the lee slope before dissipating. At times, the cap cloud will appear to roll over the ridge line and then down the lee slope very much like a waterfall. From downwind, it often resembles a stationary bank of stringy cirrus.

2. *Rotor Cloud:* Like the funnel of a tornado, this cloud gives visible evidence of violent turbulence. From the air, the rotor cloud looks like a line of cumulus clouds lying on the lee side of the mountain and parallel to it. The base is near or below the ridge line. The top may be considerably above it, sometimes merging into a great mass of lenticular clouds above it and extending up to the tropopause, whose average height is 35,000-40,000 feet. The rotor, a standing cloud, is constantly forming on the windward side and dissipating on the leeward side. Updrafts ranging to 5,000 feet per minute may be found on the windward edge and corresponding downdrafts on the lee side. Although its rotation is seldom visible from the air, this cloud is actually rotating forward toward the mountain in its upper portion and backward in its lower portion.

3. *Lenticular Cloud:* This lens-shaped cloud is the most spectacular of all the forms identifying the presence of the wave and

Schematic diagram showing air flow in a mountain wave. Compare the positions of the cap cloud, roll cloud, and lenticular clouds in this diagram with the photograph on previous page.



is the most frequently encountered. A standing cloud, it forms in bands parallel to the mountain and at fairly regularly spaced intervals to its lee. As many as 10 bands have been observed at one time, extending out forty or more miles to the lee of the mountain ridge. At other times, only one lenticular

Multiple wave formation to the lee of a mountain range with air flow from left to right.

might be visible in the lee of the most prominent mountain obstruction. Lenticular clouds are usually found at levels of 20,000 to 40,000 feet, sometimes being piled up in massive layers like a giant cake. Its color ranges from a brilliant white, often with prominent iridescence, through shades of yellow and orange, to a dark gray. Not turbulent in itself, this lenticular cloud is symptomatic of laminar flow.

The cloud formations just described may appear singly or in any combination, depending upon the moisture content of the air. The appearance of any one, singly or combined with the others, is a good indication of wave development.

On rare occasions when conditions are favorable for wave formation and the air is too dry to produce the identifying clouds, the following may be observed and accepted as an indication of such a development:

1. Wind flow at mountain top level of 25 or more knots perpendicular to the ridge.
2. An increase in wind speed with altitude up to and above the mountain top, in some cases on up to the tropopause. Within limits, wave action becomes more intense with stronger winds, but very strong winds (over 100 knots in the free air above the ridge) may eliminate smooth wave flow patterns entirely. When this happens, severe and chaotic turbulence may be expected.
3. An inversion or stable layer (increase in temperature with altitude somewhere below 14,000 feet).

The most valuable source of information to the meteorologist in forecasting wave activity is the Pilot Report. This is as true today as it was when sailplane pilots first discovered strong updrafts to the lee of mountains.

If possible, all flight through wave formations should be avoided. However, if necessary, the following precautions should be observed:

1. Avoid ragged and irregular-shaped lenticular and roll clouds since the irregular shape indicates turbulent airflow.

2. Approach the mountain range at a 45° angle rather than head-on, particularly when flying upwind. Then, if it becomes suddenly impracticable to continue, a quick turn can be made away from the ridge.

3. Because of strong downdrafts and turbulence as well as the hazards of instrument flight near mountain level, avoid flying into a cloud deck lying on the mountain ridge (cap cloud), even if it means turning back.

4. Fly clear of the roll cloud to avoid the heavy turbulence and downdrafts.

5. Because of the lower pressures encountered, do not place too much confidence in the altimeter, since it can read over 1,000 feet higher than the actual altitude in a wave condition.

6. It is possible to utilize updraft areas to gain a safe altitude for crossing the mountain range when flying into the wind. In particular, look for rising currents upwind of the roll cloud, and also the lenticular altocumulus if they are near flight level. It is not always possible to pinpoint the updraft areas, therefore use extreme caution when employing this procedure.

A well developed wave situation with powerful updrafts above and slightly upwind of the roll cloud. The airplane from which this picture was taken climbed from 15,000 to 30,000 feet with both props feathered.

Tranquilizers vs Flying Safety

Captain Robert B. Muffly, MC

ONE OF THE LATEST advances in medicine, the tranquilizing drugs, has probably received as much attention and space in the popular magazines as in medical periodicals. They have been hailed as a great boon to mankind because of their ability to replace worry and anxiety with a pleasant feeling of well being. In both medical and popular press, however, both pros and cons concerning their usefulness have been presented. These medicines are quite new and a final analysis is not yet possible but from what is known of them at this time certain statements can be made.

These medicines have considerable usefulness when used to treat emotional reactions and related conditions. *They should not be used for the purpose of escaping from the normal worries incident to living in our day with its complexities. Additional hazards are involved in its use by those individuals who have chosen occupations of unusual complexity.* [This has been officially recognized in the recent change in regulations prohibiting their use by pilots within a period of four weeks of any flying duty.]*

The reasons behind this regulation are not within the scope of the popular periodicals and thus pilots have no source of this information. This article is intended to fill that void. The

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Captain Robert B. Muffly, MC, a graduate of the University of Nebraska College of Medicine, 1952, interned in the University of Texas Hospitals and received postgraduate training in psychiatry at the Nebraska Psychiatric Institute, University of Nebraska College of Medicine in 1953 to 1955. He entered active military duty at the Medical Field Service School, Fort Sam Houston, Texas in January 1955.

He was assigned to United States Army Aviation Center from late February 1955 to January 1957, during which time he divided his service between the U. S. Army Hospital and the Aviation Medical Service of United States Army Aviation School. Throughout this time he was directly concerned with Aviation Medicine and flying safety.

Doctor Muffly returned to the University of Nebraska College of Medicine 1 January 1957 and is now receiving additional postgraduate training at the Nebraska Psychiatric Institute, Omaha, Nebraska. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the United States Army Aviation School.—The Editor.

*Change 4, AR 40-110

secondary effects of this group of medicines render them incompatible with flying safety.

Chlorpromazine (Thorazine). This is the first of the tranquilizers to receive popular acclaim. It is very useful in the treatment of emotional and mental disorders, certain of the emotionally complicated physical diseases, and nausea and vomiting of many causes. It is also an aid in anesthesia to help produce a relaxed sleep so necessary for the surgeons. However, in its use 25 side-reactions have been encountered of which 17 clearly conflict with pilot safety. These include blood pressure changes, changes in heart rate, dizziness, fainting, blurred vision, incoordination, nasal stuffiness, fatigue, stomach and bowel upsets, and sensitization of the skin to sunlight. A newer medicine, Promazine (Sparine), is very similar to Chlorpromazine and it appears that most of the defects of Chlorpromazine are shared by it.

Reserpine (Rauwolfia serpentina, rauwiloid, serpasil, reserpoid) is the other of the early tranquilizers. Its first use was in the treatment of high blood pressure but it has also been found valuable in minor and major emotional disturbances. Its side effects include most of those given for Chlorpromazine with the exception of skin sensitization and blurring of vision.

Meprobamate (Miltown, Equanil) is probably the most widely used of these medicines and yet has the least reports in medical literature. In spite of this it is already known that this preparation produces drowsiness, muscular weakness, diarrhea, and skin reactions. Some individuals may actually become more anxious and tense while taking it.

Newer medicines of this group include Atarax, Pacatal, Frenquel, and Compazine. As yet their use has been too limited to fully determine what side reactions may develop.

One thing holds true for this entire group of medicines. They interfere with the individual's ability to react. This is desirable to calm overactive persons but is not desirable where ability to react is of paramount importance as it is in the aviation environment. In addition to this, many individuals become drowsy while using them and there is a reduction of the normal protective anxieties as well as those of undesirable nature. This means to the pilot a reduction in his ability to concentrate on the piloting of the aircraft, reduction in his ability to divide his attention, reduced coordination, and slowing of reaction time. While his flying is thus impaired he may feel he's flying better than ever before.

Barbiturates and antihistamines are also prohibited for those on flying status. The barbiturates are familiar to most people as phenobarbital, nembutal, seconal and amytal. While they are useful sedatives, their defects in flying lie in the reduction of ability to coordinate, react, use good judgment, remember, and use other mental abilities.

The antihistamines (benadryl, pyribenzamine, chlor-trimeton) are useful in common colds to relieve stuffy noses and in the treatment of mild allergic conditions. They share the mental ef-

fects of the sedative-tranquilizing groups of drugs, however.

In summary, this group of medicines acts directly or indirectly on the organ most important to flying safety—the brain. Although possessing many desirable effects from the medical standpoint, their use is precluded in pilots because of resultant defects in coordination, reaction time, and ability to concentrate and divide attention. Each of the tranquilizers has more specific side effects which further impair pilot safety.

MEDICAL SERVICE
STANDARDS OF MEDICAL EXAMINATIONS FOR FLYING

Changes No. 4 } DEPARTMENT OF THE ARMY
Washington 25, D.C., 13 September 1956

AR 40-110, 12 November 1952, is changed as follows:

14. History.

* * * * * *

b. Causes for disqualification.

(1) Classes 1 and 2.

* * * * * *

(i) (Added) Individuals who are under treatment with any of the newer mood-ameliorating, tranquilizing, or ataraxic drugs for hypertension, angina pectoris, nervous tension, irritability, insomnia, etc., and for a period of 4 weeks after the drug has been discontinued.

(j) (Added) While individuals are undergoing treatment with any of the antihistaminics or barbiturate preparations.

(2) Class 3.

* * * * * *

(h) (Added) Individuals who are under treatment with any of the newer mood-ameliorating, tranquilizing, or ataraxic drugs for hypertension, angina pectoris, nervous tension, irritability, insomnia, etc., and for a period of 4 weeks after the drug has been discontinued.

(i) (Added) While individuals are undergoing treatment with any of the antihistaminics or barbiturate preparations.

(AG 702 (24 Aug 56) MEDCA)

By Order of Wilber M. Brucker, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

Memo from Flight Surgeon

A physician was the first American to fly. In 1784, Dr. John Jeffries made a balloon ascent in France and—because he was a man of science—carried scientific instruments along to take observations. Later he published a book.

Aviation medicine did not become organized until 1917 when World War I provided the impetus to establish this new field of medical science. It became evident that it was necessary to select men who were free of physical and mental deficiencies to fit into and function efficiently in this strange new air world. The physician who entered this specialized field of medicine was confronted with problems never before encountered. The importance of aviation medicine was soon recognized, and it has enjoyed a steady growth since its inception.

Today the flight surgeon is an organic part of aviation. As both a physician and flyer he is concerned with and knows intimately the personal and family situations of the pilot as well as the latest experimental and practical solutions for the prevention and treatment of illness and injury.

The DIGEST is proud to present a new department devoted entirely to the advice and findings of this integral and necessary member of the flight team—your flight surgeon.—The Editor.

CARBON MONOXIDE

Most of us associate carbon monoxide with the tabloid news story. An unhappy man decides to escape his troubles. He steps into the garage, pulls the sliding door shut, writes a note to his wife, and starts the motor. We pause a moment over the story before passing to the sports page. We recognize the hazard and resolve to take more care because carbon monoxide is an insidious poison, a stealthy killer without odor or color or taste. Then we scan the latest basketball scores and that's that.

Yet, in flying any single engine aircraft, we breathe at least a trace of this dangerous

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Views expressed in this department are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

gas. And while a fatality resulting directly from monoxide poisoning is a rarity, the inattention, muscular incoordination and sleepiness induced by the less than lethal quantity may result in a serious accident.

Carbon monoxide does no direct harm to the tissues of the body but strangles them by cutting off the supply of oxygen. Each time we breathe fresh oxygen into the lungs it combines loosely with the oxygen carrier of the blood called hemoglobin. The resulting combination, oxyhemoglobin, travels the arteries to the various organs of the body where it readily gives up the oxygen to the hungry tissues. The hemoglobin is returned through the capillaries of the lung to pick up a fresh supply of life-maintaining oxygen. When carbon monoxide is breathed, it seeks out the hemoglobin and because of a greater affinity combines with it in place of the oxygen. It combines with hemoglobin about 200 times easier than oxygen which is now left behind while the useless—and thus lethal—carbon monoxide is constantly circulated in the blood because of the firm combination with the hemoglobin, thus causing internal strangulation.

The effects of carbon monoxide are so disastrous that preventive measures are the only ones to be relied on. A constant check must be made for breaks in the firewall or for unsatisfactory cabin sealing, and personnel must realize the possibilities of exhaust contamination. In cases of actual poisoning, elimination from the circulatory system requires a number of hours under ordinary conditions. The process is greatly accelerated by breathing pure oxygen.

NEVER LET ILLUSION...

Every one of us holds illusions. When we are young, we hold a great number of them and even as we grow older we hesitate to part with many of our more cherished beliefs even though the duration of life and experience may present us with contrary evidence. This may be harmless, normal and human, or simply exasperating to the person who does not hold your particular illusion.

Certain sensory illusions, however, can be dangerous. The pilot who persists in clinging to them despite advice and experience may jeopardize his life and the lives of his flight companions. The illusion of a moving object in the field of vision has, in the past, caused a number of training accidents. It occurs when fixed points of reference are either inadequate or missing and is given the very imposing label of the autokinetic illusion.

While night flying in formation, the unwary wingman may decide that his flight leader is drifting or turning. If he corrects his controls unthinkingly they may collide. It has happened. The alert wingman will not stare. He learns the value of "rubber necking" and the "roving gaze" to cross-check his instruments containing the invaluable point of visual reference, thus he avoids disaster by countering his intuition.

The seat of the pants is an apt descriptive term for the somatic senses which transmit signals to the mind of the pilot

helping him determine his position in space. In ordinary life, in walking, climbing stairs, and the like, these signals are adequate, correct and necessary. The pull of gravity on a man's muscles, joints, viscera and skin is one of the normal cues for maintaining equilibrium.

Flying, however, is a different problem. The pilot as an ordinary human responds to gravity unthinkingly. As a pilot he must learn and keep in mind that centrifugal force may be added to the force of gravity and the resultant may transmit a misleading message from the "seat of his pants" on which he is resting to his brain. On the ground a man may check the truth of these subconscious signals by merely opening his eyes and establishing a "point of visual reference." He must do the same flying blind. Since the other signals are so persistent he must in each and every illusion cross-check his instruments containing the "visual point of reference" and comply with its decision. Repeatedly making a liar out of one's intuition over a period of years will eliminate the hazard caused by sensory illusions.

In certain tests it was found that a blindfolded pilot could be slowly tilted from 10 to 25 degrees without his knowledge. Banking in a turn, then, may not be perceived but the pilot distracted by the pressure against his seat, telling him simply and wrongly that his nose is up in a steep climb, corrects for the illusion and dives.

Or in coming out of a turn the blind pilot may think he is diving. The pressure against the seat lightens; he wants to float. Answering the "message" he pulls back on the stick and stalls, perhaps spins with serious results. There is only one cure for these illusions: absolute faith in the instrument panel and the "point of visual reference," namely the "artificial horizon" or its substitute.

QUALIFICATION MEANS SAFETY

Captain F. E. W. Smith

THE MOST IMPORTANT WORD in the language of pilots is "safety," a word and a thought which we can never ignore.

There is nothing which man does but which involves a risk of some sort. People have killed themselves by getting out of bed, by eating, even by sleeping. No one can go through a single day without taking innumerable risks of one kind or another, most of them small, some of them perhaps big. The term "safety" does not mean freedom from danger because there is no such thing, danger being about us always. It does mean the application of skill and knowledge to a given situation of risk, which results in a satisfactory reduction of the hazard.

POSITIVE VALUES

Hazard and risk are terms which have positive value, in that they describe the amount of danger inherent in any given activity. Most of the duties of life contain little risk, some are hazardous and some so dangerous that few men will attempt them. These we say are unsafe, but we are misusing the term, for they may be unsafe or they may be safe depending on the knowledge, skill and suitability of whoever is doing them. A man conditioned to an undertaking of great hazard, who fully understands the dangers which oppose his success, and who possesses or has devised a "safe" method of combating these dangers, may actually be safer among his risks than he might be doing things which he considers are without hazard. The term "unsafe," as applied to any dangerous undertaking, relates to the improbability of avoiding the risks which are inherent. When methods have been devised which give the individual an acceptable chance of success over these risks, the activity becomes "safe"—for those who understand the methods and who are fitted to apply them. It is still "unsafe" for those who are not suited and who remain in ignorance.

There are innumerable examples of the truth of this statement and only a few days ago the writer witnessed an excellent one. A high rigger threw his hat in the air from the top of a 100-foot tree—and beat it to the ground. To say the feat was hair-raising is an understatement. To say it was risky is indisputable, for the hazards of that mad scramble down the tree were most evident. But to say it was unsafe is wrong, for

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Captain F. E. W. Smith is a commercial pilot for Trans-Canada Airlines. His article appeared first in CANADIAN AIRLINE PILOT ASSOCIATION *magazine and was reprinted by the Flight Safety Foundation, Bulletin 57-100. Views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor*

the tree climber was a professional performer who had been doing the same stunt twice a day for a number of years, and who has never been hurt doing it.

THREE REASONS FOR FAILURE

When a stunt man finally is killed doing his specialty, it is popular to note his passing with the observation that his stunt was most unsafe. It would be more correct to say that his dangerous occupation had become unsafe for him at the moment of his accident, and it is probable that one or more of three reasons will explain its cause. First, he may have been unsuited, for men often display more nerve than good judgment in their ambitions. Second, the performer, his awareness of danger dulled by over-familiarity with his act, may have become careless in some way in the application of his techniques. Third, some hazard, unforeseen and hitherto unencountered, may have, in this instance, transformed an act which had been safe for him into one which was unsafe, and he had not been able to solve his problem in the limited time available to him.

The man who wishes to do the hazardous and live must first be suited to his task. Then he must maintain a constant appreciation of the danger of what he is doing, and hold in deep respect the forces of destruction which are about him. He must be vigilant in his search for hidden dangers, ones which he has not encountered and hopes he never will, but which may face him some day in a most unexpected way. When he has discovered these, he must try to devise techniques which will defeat them, for if they catch him unawares, he will be lost.

EVALUATING THE HAZARDS

This abstract discourse on the relation between hazard and safety, and the life and death of the stunt man, is appropriate for pilots because flying is one of the world's most hazardous occupations. Yes, we who are accustomed to think of ourselves as sober and cautious men, pillar-of-the-community types, are actually closely rated to the high rigger and the high-wire performer. For flying is simply loaded with risks. We are as surrounded with them as we are with instruments: risks of engineering, of construction, of maintenance, of performance, of traffic, of weather and of our own abilities. A good way of evaluating the actual net hazard of the occupation is to contemplate the chance which an ordinary individual, untaught and ignorant of aircraft, has of stepping into a modern airplane and successfully completing any kind of flight. The probability of such an attempt ending safely is as low as the chance for success the same inexperienced individual has in attempting to duplicate the feat of the high rigger.

But as the rigger, with knowledge, skill and practice, is able to perform his act with safety, so is the pilot. We learn to fly. We study out the many hazards inherent in our occupation and are taught techniques which remove them. This is the only safety in flight, for the risks are ever present, unchanged from

the days of the Wright brothers. It is the improvement and invention of technique, both of pilot and engineer, the enormous increase in knowledge of the air, of airplanes and of how to build them, that has made aviation the safe, effective transportation of today. These spectacular advances have not, however, made the air one bit less hazardous.

TWO CAUSES

It was pointed out above, assuming suitability, that when an accident occurs in a hazardous occupation there are two causes. Either the individual involved has become careless, or has been faced with some hazard new to his experience which he has been unable to combat. This is always true in the air. Of carelessness little need be said, for its consequences are impressed on pilots at the earliest age. But it is perhaps advisable to point out that mistakes of carelessness are the errors of experienced men and occur because they have lost the awareness of danger which is essential to their survival. The carelessness of the green but potentially competent pilot is an indication of his lack of skill.

New hazards must be of a type which cannot be simulated in training for otherwise the pilot would be instructed in them. The word "new" also relates to the experience of the individual concerned, for it is possible that the same thing has confronted others. Such are of two main types: those which can be controlled and those which cannot be controlled. A pilot is able to learn much about the first type since if such has happened to anyone who has been able to succeed over it, a contribution to the general knowledge is made. A pilot can only conjecture on the second type, for there is seldom a witness reporting the encounter.

TWO REMEDIES

There are two ways of seeking safety from the new, or as yet unmastered, hazard. First is avoidance. If you feel unequal to the risks of tree climbing—don't climb trees. Avoid flying maneuvers which might cause destruction of the machine, unless properly equipped and prepared to meet the emergency and armed with a plausible excuse to top off the parachute ride home. If your aircraft is a single engine VFR job and you are not competent to fly on instruments—don't take an IFR jaunt anywhere, any time.

The second way is to expand the limit of what can be done safely by education and equipment. This involves learning all there is to know about the hazards which can normally be expected, and about as many unusual ones as one can. It involves conditioning (meaning the attainment of a mental attitude) and of physical skill, which will enable the man concerned to do what he knows should be done when required. And it demands possession of proper tools for the job. The tree climber does not perform his act in running shoes, with a clothesline safety belt. He has spurs, a wide belt and a very special rope. So does the pilot need a good aircraft, proper instruments and sufficient radio equipment before he can make a regular feat out of

flying on schedule.

It has been shown that the term "safety" means the doing of something dangerous in a way which removes the risk. It was also pointed out that it is popular to misdefine the term and use it as an expression of the actual danger which is involved. People would do better if they said: "This is unsafe *for me*," rather than say: "This is unsafe." The latter expression limits the experience of him who uses it for, having proclaimed the act unsafe, positively and definitely, his only recourse is in avoidance. Had he used the first expression he would have recognized the possibility that, with training and experience, it could be safe — for him — and would thus permit an expansion of his capabilities. Pilots are no different than anyone else in their tendency to limit themselves in this way. While we would all disagree with an average man's statement that flying is unsafe, we do place arbitrary limits on what we will do in the air, and say that certain flying operations are unsafe (e.g., tornado flying). We neglect to add the words "for us," and thus rule out the possibility that some day a technique may be devised which will make such flying safe. We see our safety in avoidance which, until we are equipped to meet the hazard, is, of course, the only thing we can do.

MASTERY vs AVOIDANCE

Avoidance is a very basic right, for no human can be expected to take physical risks which are beyond his capability. No one is ever compelled to climb trees or to fly airplanes. However, to those who have chosen these occupations, avoidance is a luxury they can ill afford. In considering tree-climbing, it is easy to see that there is safety only in complete mastery. The sooner the rigger attains such skill that he is able to overcome all foreseeable dangers, and has thought out solutions to all situations which may conceivably arise, no matter how unexpectedly, the sooner his factor of safety becomes acceptable. The pilot is in exactly the same situation. If, for example, he has decided that it is unsafe to fly on instruments, because, perhaps, of the dangers of ice and turbulence which lurk in cloud, he will seek to avoid all cloud flying. This is fine—except that some day he will not be able to avoid the cloud and, because he has limited his skill and knowledge, he will be in great danger in a situation which another pilot would term routine.

CARE AND COMPETENCE

In any dangerous occupation, and flying is such despite statistics, the safety of avoidance is largely illusionary. The only safety is in care, which is a must, and competence, which is skill developed through study, practice and experience. The attainment of this competence is a continuing process, for no one can ever say he is master of *all* emergencies. Any pilot who stops his progress to an ultimate mastery of the air, who says to himself that he knows all he wants to, or needs to know of flying, is deluding himself and is placing himself in a position where he must seek safety in avoidance. Once he has so de-

cided, his operation ceases to be safe.

Anticipation of emergencies, devising means of surmounting them, improving on existing techniques, all are highly profitable ways for a pilot to spend his time. For one thing, such activity makes him safety-minded, not chance-minded. For another, by continually expanding what he can do, it makes him progressively safer in the air, putting real value into his experience.

Summary of Accident Experiences

FROM: Commanding General, United States Third Army, Fort McPherson, Georgia

TO: Commanding General, United States Army Aviation Center, Fort Rucker, Alabama

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Following message from Department of the Army is quoted for information and compliance: "Pending revision of SR 385-10-40 and SR 385-10-41 . . . following changes in definitions of Army aircraft and motor vehicle accidents and record thereof will apply:

A. Army aircraft accident—accident involving damage to aircraft between time engine or engines are started for purpose of commencing flight until time aircraft comes to rest with all engine and propeller stopped, upon completion of flight, regardless of responsibility.

(1) Major accident—aircraft accident in which aircraft is destroyed or so severely damaged as to require major overhaul or replacement of some major assembly such as wing, main rotor, undercarriage, tail or engine before it is again air-worthy.

(2) Minor accident—aircraft accident in which aircraft received only minor damage which is easily repaired such as broken wheel, rudder, prop, cylinder or oil cooler.

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D. Paragraph 5c(1), SR 385-10-41, superseded as follows:

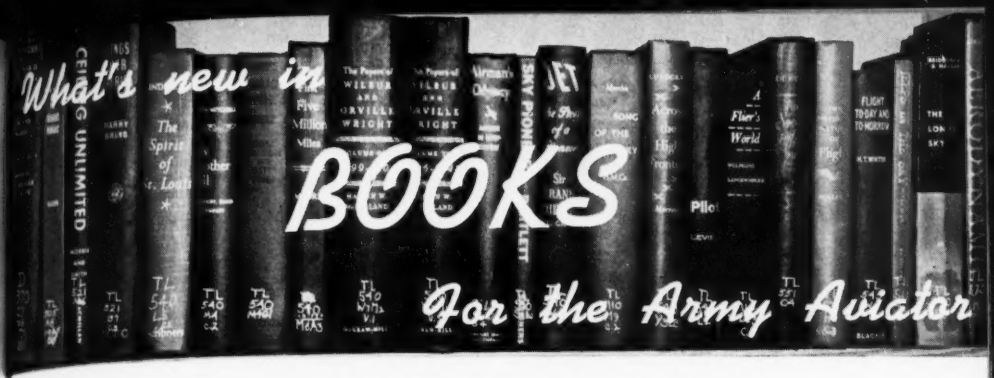
(1) Army aircraft accident rates based upon total flying hours:

a. Number of "major" accidents per 100,000 flying hours

b. Number of "minor" accidents per 100,000 flying hours

c. Total number of "major" and "minor" accidents per 100,000 flying hours

d. Rate for total number of "major" and "minor" accidents will be included in Army aircraft section of DA Form 953 together with total number of these accidents and total flying hours. Individual rates for "major" and "minor" and number of accidents in each category will be included on back of DA Form 953 and so positioned as to be identified with appropriate organization on face of form."



A MILITARY HISTORY OF THE WESTERN WORLD (3 Vols.)—Major General J. F. C. Fuller (Funk and Wagnalls Company, New York, N. Y. 1955. Each Vol., $6.00; set, $16.50)

Reviewed by Brigadier General Carl I. Hutton, *USA*
Commanding General, The United States Army Aviation Center

General Fuller has been a leading advocate of mobility in warfare for more years than most soldiers on active duty can remember. Consequently, it is no surprise to find that mobility shares an equal place with firepower in his presentation and analysis of the battles and campaigns in these volumes. In the present period of great firepower, both atomic and conventional, those who are concerned over the problem of developing mobility on a scale to match the firepower, will find thoughtful background material in these studies of past battles. In particular, Army Aviators can study the steps in the development of tactical mobility from the loosening up of the battle formation which made the legion superior to the phalanx to the armored formations of World War II. Since Fuller's treatment ends with World War II, the solution to what will constitute the next major advance in mobility for land warfare does not appear. Those who feel that the only possible solution lies in achieving perfect cross-country mobility by mounting the soldier in a tactical flying machine will find nothing in Fuller to discourage their beliefs.

There are two sources of minor irritation in all three volumes. The editorial job appears to have been done rather sloppily. There are minor errors of dates and actions which should have been caught. The second short-coming is the cartographic work. The maps which are included are well done, and they survive the basic test of battle maps which is whether the reader can find the places named in the text. However, the number of maps is entirely inadequate and the reader will find himself wading through page after page of descriptions based upon place names without maps to tie the text together. This is the fault of the publisher and not the author.

These short-comings are minor, and they do not alter the recommendation of this work as a compilation and guide for the study of the military past which —in the words engraved on the front of the archives building in Washington, D. C.—is prologue.

Book reviews appearing in this department do not necessarily reflect the opinions of the Department of the Army or the U. S. Army Aviation School.—The Editor

The Gray Hair Department

HIGH OVER A BARRIER with 60 degrees flaps, a pilot was gliding his L-19 down the approach into a 2,200 foot tree-lined strip. The ground control officer alerted the pilot that his approach looked slow. According to the pilot "Airspeed indicated between 55 and 60 mph; at the time the ground controller's voice came through the earphones, the rate of descent increased. The nose dropped and I applied full power. This happened about 15 feet above the runway, and power was not in time. The aircraft crashed."

The gear folded and the air-

Lieutenant Colonel Charles Ernest, the senior Army Aviator pictured above, is the Commanding Officer of the 3rd Transportation Battalion (Helicopter), Ft Benning, Ga. In addition, he is the Executive Officer of The Lawson Airfield Command at Ft Benning. After leaving the University of Hawaii in 1937, he began his Army career as a 2nd Lieutenant Platoon Leader in the 299th Infantry, Territory of Hawaii. He later became the battalion Adjutant and held this assignment until being transferred to Headquarters, the Hawaiian Department, Department of Signal, in 1941. Early in 1943, Colonel Ernest was sent to Pittsburg, Kan., for Liaison Pilot training and subsequently graduated in class No. 3 at Ft Sill, Okla. He returned to Hawaii as the Aviation Officer for the Pacific Area, Headquarters, Hawaiian Artillery Command. He remained in this assignment from 1943, until the middle part of 1944, when he was reassigned to Headquarters, XXIX Corps Artillery, as Corps Aviation Officer. He later returned to Headquarters, Hawaiian Artillery Command, as the G-4.

In 1948, Colonel Ernest was assigned to the American Mission

craft skidded 21 yards on its nose. Weather conditions were clear, with a 15 mph gusty head wind.

The pilot allowed his airspeed to fall below the minimum required for effective control. The approach slowed up as he came over the trees. He was riding the updraft which is usually found at the downwind end of a confined area strip, and it sustained his altitude. Attempting to maintain his approach angle, the pilot held a constant attitude and reduced throttle. The rate of descent increased, the airspeed dropped off and rapid settling resulted. Airspeed which had been between 55 and 60 mph was now dropping below 55 mph as the aircraft descended below the tree tops into the area where the wind was almost calm. The differential in wind velocity had the same effect as closing the throttle or increasing the angle of attack with stick. The elevators lost their control effectiveness 15 feet above the ground and the nose dropped. Full throttle could not regain effective elevator control to level the aircraft by the time it struck the ground.

With 60 degrees flaps and airspeed below 60 mph (depending on gust conditions), power is required to maintain elevator control. The drag induced by the flaps is so great that elevator control will be lost as soon as power is reduced. Keep a few extra miles per hour airspeed when flying in gusty wind conditions or into confined area strips where changes in wind velocity may be expected.

BEWARE CREEPING STICK

A pilot was returning from an administrative mission in an L-19. He entered traffic, applied 45 degrees flaps on the base leg, turned final, and executed a power approach. A five mph breeze was blowing steadily down the runway. Approximately 15 feet above the runway the aircraft began settling rapidly, and the pilot applied power, with no ef-

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to Greece as the Aviation Advisor to the Greek Army. During this tour he organized the first Army Aviation Unit for the Greek National Army, organized the first Greek Aviation School at Athens, and took command of the first Air Observation Post Squadron (Greek) in the Vitsi-Gramuios campaign under General Van Fleet.

During the Korean War, Colonel Ernest was assigned as the Aviation Officer for the United States I Corps in Korea through 1952 to 1953. He returned to the Army Aviation School, Ft Sill, Okla., as Director of the Flight Training Department and was appointed the Executive Officer of the Aviation School Command, while the School was being moved from Ft Sill, Okla., to Ft Rucker, Ala. However, he remained at Ft Sill after the move and organized and commanded the 45th T.C. (Helicopter) Battalion (H-34) and the Army Aviation Unit Training Command.

In his 14 years as an Army Aviator, Colonel Ernest has accumulated over 4,000 hours of first pilot flying time and has flown every operational aircraft the Army has used. He has held an instrument rating since the instrument program was initiated in 1951 and is current in all types of Army fixed-as well as rotary-wing aircraft.

Stalled on the approach 15 feet above the runway.

fect. The airplane stalled and hit the ground hard, spreading its gear. The propeller dug into the runway, and the bottom of the fuselage scraped. Damages amounted to $3,711.56.

The differences between this accident and the one above are that there was a steady light wind blowing and the pilot applied too much back pressure too soon.

When executing a power approach, be careful not to attempt to correct overshooting by the application of back stick pressure. This is the difference between accuracy control in a normal glide and accuracy control in a power approach. There is no cushion of extra airspeed. The throttle is the up and down control and the stick is the airspeed or angle of attack control. If over-shooting, the throttle should be retarded to increase the rate of descent, but retarding the throttle also increases the angle of attack of the relative wind. Therefore, the nose should be lowered to keep a safe airspeed. Thus the altitude control (power) and the airspeed control (elevators) must always be coordinated.

The Gray Hair Department is prepared by the U. S. ARMY AVIATION DIGEST staff with information obtained from the files of the U. S. Army Aviation Safety Board. Views expressed in this department are not necessarily those of the U. S. Army Aviation School or of the Department of the Army.—The Editor.

LEFT IS RIGHT

Two pilots checked out an L-19 to practice night landings and takeoffs. After pilot number one completed his practice, he pulled off to the side of the strip and changed seats with pilot number two. The second pilot ran through his cockpit check, feeling the fuel selector valve for its position. He started the engine, taxied to the run-up position, completed the run-up check, cleared himself, rolled onto the runway and applied takeoff power. The aircraft became airborne and climbed approximately 50 feet when the engine quit. The pilot lowered the nose and pumped the throttle a few times. The engine caught momentarily and stopped again. The airplane hit the ground hard, striking the propeller and the lower part of the fuselage on the runway. It rolled 36 feet and became airborne, floated 54 feet more, touched down and rolled for 270 feet, then made a 360 degree ground-loop.

The engine quit because of fuel starvation. The fuel selector valve was turned to the low

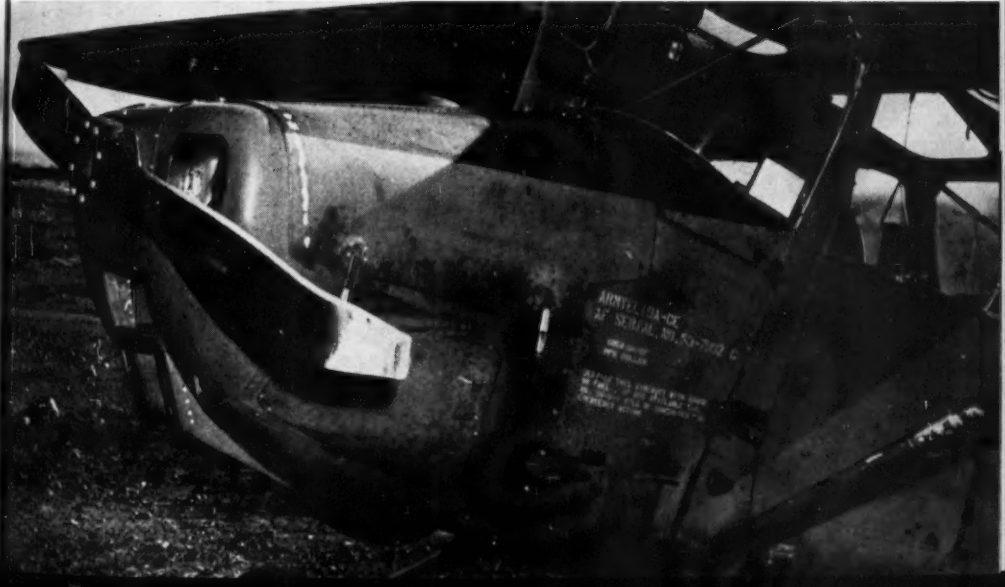
tank. Although procedures cannot substitute for care, between starting the engine and takeoff in the L-19, the fuel selector valve is checked three times according to the procedure taught at the U.S. Army Aviation School. Before starting, the fuel selector valve is set to the lowest tank. Taxi out to the run-up position is accomplished with the selector valve on the lowest tank. Just before run-up, the valve is switched to the fullest tank and left there. Each time the tank quantity gauges are visually checked, and the position of the valve is visually checked. Then, prior to takeoff, a final check is made. Although it is possible to feel the position of the valve, it is not possible to feel the reading of the quantity gauges nor to read the label on the fuel selector valve panel. Therefore, the flashlight must be used at night in order to read both the gauges and the position of the valve.

Another factor is present, especially when an aviator has not flown an L-19 for some time. The main tank is in the left wing. When the fuel selector valve is turned to the left, it is on the auxiliary tank position which is in the right wing. Do not confuse these positions by thinking that when the fuel valve is to the left it is on the left (or main) tank. Read the signs and perform the proper preflight checks. This is the only insurance against recurrence of accidents caused by this type of pilot error.

BRAKES!

Two mechanics climbed into the cockpit of an L-20 to perform the three-day run-up check. The mechanic in the left seat went through the cockpit and pre-starting check and, noting that the parking brake was in the "on" position, left it there. He started the engine and moved the propeller control into high rpm, then attempted to contact the tower for taxi instructions to the run-up area. The battery was too weak to power his radio, so he increased rpm to 1000 to cut in the generator. As rpm in-

Fuel starvation caused engine failure after takeoff.



Crew-chief did not reset brakes before starting the engine.

creased, the L-20 moved forward. The mechanic pressed hard on the service brakes without result, then quickly closed throttle and cut the switches. The aircraft continued rolling across the taxi area, through a drainage ditch, and into the tail section of a parked L-19.

Improper procedure by the mechanic caused the accident. He did not reset the parking brake before starting the engine. The L-20 had been parked for three days with its brake system under pressure, and the hydraulic fluid gradually seeped through the master cylinder causing "brake fading." This accounts for the parking brake not holding the aircraft when rpm was increased.

NO PRIOR RECON

A unit H-23 pilot was giving an area orientation to a newly arrived pilot. During the course of the orientation ride, the pilot descended to an altitude of 20 feet over a firebreak, and slowed down to 40 mph to practice contour flying. Suddenly a telephone wire appeared in their flight path, too late for the pilot to avoid it. Although he bottomed the collective pitch, the H-23 struck the wire and began to vibrate violently. It spun to the right and pitched downward. The pilot closed the throttle and the helicopter hit the ground hard in a nose low attitude. The main rotor blades struck the ground and were destroyed. Fortunately no injuries were received by either occupant but $5,482.42 damages were incurred.

Although the aviation unit had a designated contour flying area, the pilot conducting the orientation ride was not aware of the fact. He stated that he gave the same orientation ride that was given to him when he joined the unit.

Apparently reading the unit SOP and local flight regulations is not a part of the new pilot orientation and checkout in this unit. Safe contour flying is a skill which can only be devel-

oped by practice. Nevertheless, it is extremely dangerous unless careful procedures govern its practice. The following may be superstition, but it seems like a good SOP to schedule periods of contour flying under supervision of the aviation officer. At other times, aviators should fly in accordance with regulations. (Note, Regulations pertaining to contour flying are found in AR 95-8 para 15, a (3); and para 35; and AR 95-32 para a. (5).

Contour flying.

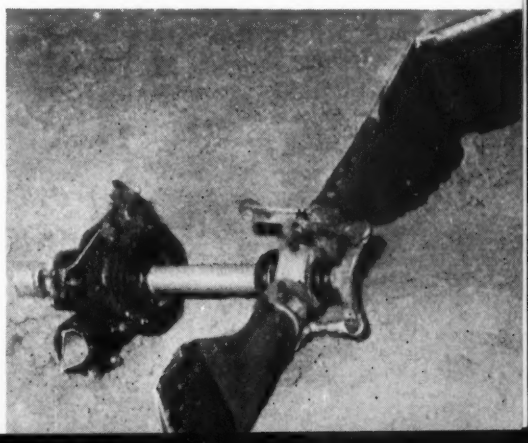
KNOW YOUR SAFETIES

Flying a service mission, an aviator in an H-13 felt a high frequency vibration develop in his pedals. He quickly discovered that when he added pressure on the right torque pedal the vibrations subsided. However, the vibrations continued to develop and he was forced to keep increasing right foot pressure. He turned to the right into the wind to make an approach and land in a clearing to determine the cause of the vibrations. Midway in the turn the anti-torque system failed. The aircraft completed two 360 degree turns before the pilot could bottom the collective pitch for autorotation. He managed to regain directional control with 30 mph airspeed at about 200 feet of altitude. By this time he had drifted away from the clearing, and the main rotor blades struck the tree tops. The helicopter landed and slid a few feet before colliding with a tree trunk.

Investigation revealed that the tail rotor pitch-change-head-nut was not safetied and had become partially unscrewed. The resulting vibrations caused one of the tail rotor blades to fail and break off. The tail rotor gear box assembly sheared its housing and fell to the ground.

There is no criticism implied here of the aviator's flight technique. When an aviator succeeds in getting the helicopter to the ground without injury to the occupants, following the loss of the tail rotor gear box, he is to be congratulated. Determination of proper safety wiring of the tail rotor pitch-change-head-nut, prior to the flight, might have prevented the accident. It could not be proved whether or not the nut was safetied before take-off on this flight. Maintenance records show that the tail rotor inner shaft was replaced 13 days before the accident. Six days prior to the accident, the head nut was written up as being loose. Maintenance personnel

Anti-torque failure.



felt certain that the nut was safetied, and further proof was the fact that the "accordion boot" dust cover (boot, tail rotor drive) showed marks where a safety wire had been installed.

It is unlikely that the safety wire would fail in a six-day period. It is more probable that the safety wire was not replaced when the nut was tightened. This would not require replacement of the "accordion boot" cover, and the boot would show the safety marks of the first installation 13 days prior to the accident. Regardless of the evidence, this accident proves the critical importance of thoroughly preflighting an aircraft down to the safety wires.

A WRONG "GUESTIMATE"

An H-19 aviator estimated the space between two parked H-19s to see if there was enough room through which to taxi his helicopter. He believed that by slightly turning the blades of one helicopter, and with the assistance of two mechanics and another aviator to guide him, he could make it. After preflight and warm up, he moved his helicopter out of its parking spot and turned 90 degrees to line up with the opening. He taxied slowly and cautiously, intently observing the signals of his guides. There was a clicking sound and he felt a vibration in the cyclic stick. He looked to his right and saw that the main rotor blades had struck the tail rotor of the parked helicopter on that side.

It would have been much easier for the aviator to move one of the parked H-19s rather than try to taxi the 53-foot rotor disk through a 53-foot space. All the "wing-walkers" or guides on the airfield are of no use when good judgment is abandoned.

This is the type of accident which causes the Aviation

A 53-foot rotor disk failed to clear a 53-foot space.

Improper recovery from ground resonance caused this hard landing.

Safety Board to feel that supervisory error is frequently underestimated in our accident reports. An aviator ordinarily would not attempt to taxi through such a confined space unless the practice was habitual in the unit and condoned by the supervisor.

KEEP YOUR SEAT!

On a tactical low-level, cargo-hauling mission, an H-34 aviator executed a flight pattern to the landing area and made a normal approach. He established a rate of descent of approximately 500 feet per minute, 60 knots airspeed, with 2500 rpm. At the 100-foot point, he increased rpm to 2700 and applied collective pitch, bringing the helicopter to a hover, then decreased rpm to 2500 for the touchdown. As the helicopter began to settle onto the ground, the co-pilot endeavored to expedite the unloading operation by unfastening his safety belt and moving out of his seat toward the cargo compartment. When he stood up, he inadvertently hit the cyclic stick and pushed it to the right. The pilot quickly recovered to the left, and the helicopter immediately began a rolling, shuffling motion. The pilot increased collective pitch slightly to stop the motion, but the rolling movement quickly changed to violent vibrations, and he bottomed the pitch. The ground control officer commanded the pilot over the radio to pull pitch and "break" ground contact. He did. The helicopter rose 15 feet, still vibrating so violently that the co-pilot was being bounced and battered about on his side of the cockpit. When it became airborne, the H-34 rolled steeply. The co-pilot, grappling for anything he could hold on to, grabbed the mixture control, jerked it into idle cut off, and broke the handle. The engine quit, the H-34 swung 90 degrees to the right and hit the ground hard.

In dealing with the known ground resonance characteristics of the H-34, the dash one prescribes that the helicopter either be brought firmly into the air immediately or that it be put firmly onto the ground. Practical experience among H-34 pilots has shown that it is usually better to increase pitch promptly and get into the air. In any event the pilot must make an instantaneous decision in which several factors must be considered: load condition, rpm, the degree to which the load has been transferred to the landing gear, etc. Furthermore, the enthusiastic co-pilot compromised the situation by cutting the engine off, and, with collective pitch still applied, the rotor rpm dropped below supporting speed

by the time ground contact was made. It should also be pointed out that the crew chief, in the cargo compartment, had unfastened his safety belt and was about to open the door; and the ground unloading crew had run to the side of the helicopter.

This accident could have resulted in the deaths of these men. Expediting loading and unloading operations should begin after the helicopter is firmly on the ground—and preferably on signal by the pilot. Until then, all should keep their seats, and this should become a routine part of the preflight briefing.

FOR WANT OF A BOLT

A unit instructor pilot was demonstrating slope landings to an aviator as part of his H-34 check-out. On the fourth slope landing, they landed into the slope with the tail wheel resting low. The pick-up to a hover was smooth, but the tail continued to rise. The instructor grabbed the controls quickly. The cyclic was full back, but the tail still continued rising until the main rotors struck the ground. The H-34 pivoted up on its nose, then rolled over on its left side.

Examination of the fore and aft cyclic system revealed that a bolt securing the fore and aft push pull rod end bearing to the bellcrank was missing. The bolt and nut were found and taken to the analytical laboratory at a nearby Air Force base. The laboratory reported that a cotter pin or safety wire had been sheared by over-torqueing the nut which caused scoring of the bolt threads. This scoring prevented the castellated nut from being screwed down far enough for the nut slot to line up with the safety hole in the bolt. The crew chief admitted that he sometimes removed hard-to-get-at cotter pins and safety wire by shearing. During the last periodic inspection, the Tech Inspectors had the crew chief remove the bolt for purging and re-inspection of the rod end bearings. Safeties were not made on re-assembly. Improper removal and installation of this bolt and nut, costing but a few cents, resulted in a $194,100 accident.

Maintenance error — fore and aft push pull rod was not "safetied."